

# THE U.S. ARMY CORPS OF ENGINEERS NEW ENGINEER MANUAL “DREDGING AND DREDGED MATERIAL MANAGEMENT”

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## ABSTRACT

The U.S. Army Corps of Engineers (USACE) has updated and merged its dredging Engineer Manuals (EMs) into a single document. This new EM, Dredging and Dredged Material Management, consists of updated versions of the three previous EMs, Dredging & Dredged Material Disposal (EM 1110-2-5025, 1983), Beneficial Uses of Dredged Material (EM 1110-2-5026, 1986), and Confined Disposal of Dredged Material (EM 1110-2-5027, 1987). In addition to these revisions, this document includes a new section on open-water placement. The terms disposal and placement are used synonymously to describe the dredged material deposition after its removal from the dredging prism. This paper provides an overview of this comprehensive document. The new edition describes the dredging equipment and disposal techniques used in the United States, and provides management, engineering, and design guidance for activities associated with new work and maintenance projects. This manual also provides guidance: 1) on the evaluation and selection of dredging equipment, 2) for planning, designing, constructing, operating, and managing open-water and confined dredged material disposal areas to provide adequate storage volume for both short-term and long-term disposal needs, and 3) for planning, designing, developing, and managing dredged material for beneficial uses, incorporating ecological concepts and engineering designs with biological, economical, and social feasibility. In addition to detailed technical procedures for various design and operations functions, this EM contains numerous citations for the literature, especially peer-reviewed literature, because use of peer-reviewed procedures and methods is critical in gaining credibility and acceptance of designs and evaluations in the regulatory arena. This new EM will be made available on the USACE web site for unlimited distribution.

**Keywords:** Dredging, dredged material management, open water disposal, confined disposal, beneficial uses.

## INTRODUCTION

The USACE has been concerned with the development and maintenance of navigable waterways in the United States ever since Congressional authorization was received in 1824 to remove sandbars and snags from major navigable rivers. The USACE navigation mission entails maintenance and improvement of about 40,000 km (25,000 miles) of navigable channels serving about 400 ports, including 130 of the Nation's 150 largest cities. This system of harbors and waterways remains one of the most important parts of the Nation's transportation system. The viability of the economy of the United States is dependent upon maintenance of the waterways, ports, and harbors for navigation. Dredging is a significant method for achieving this navigation mission.

The USACE accomplishes the majority of its annual dredging workload by contracting privately-owned equipment under competitive bidding procedures and performs the remaining work using USACE (Corps-owned) dredges. The average annual volume of material dredged from FY96-98 is approximately 207 million cubic meters (270 million cubic yards) of material. About 46 million cubic meters (60 million cubic yards) are placed in ocean waters at about 108 sites approved by the U.S. Environmental Protection Agency (USEPA). The remaining materials are placed in a variety of locations, including uplands, beach sites, near shore waters to create wetlands and riverine sandbars (Verna and Pointon 2000).

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The Dredging and Dredged Material Disposal EM (1110-2-5025) was published in 1983 to assist USACE personnel to accomplish their navigation mission (USACE 1983). This EM was followed by the Beneficial Uses of Dredged Material EM (1110-2-5026) released in 1986 (USACE 1986). The Confined Disposal of Dredged Material EM (1110-2-5027) was published the following year in 1987 (USACE 1987). A lot of changes have re-shaped the business of dredging since that first EM was published in 1983. A significant number of these changes are reflected in the new USACE EM. Note that the number for the new EM Dredging and Dredged Material Management (1110-2-5025) is identical to that of the 1983 EM Dredging and Dredged Material Disposal, since the new EM essentially supercedes the old EM series. This single document consists of merged and updated versions of the three previous EMs, Dredging & Dredged Material Disposal, Beneficial Uses of Dredged Material, and Confined Disposal of Dredged Material, and also includes a new section on open-water placement. An overview of this comprehensive 900+ page document is presented hereinafter.

## **DOCUMENT STRUCTURE AND AVAILABILITY**

### **Document Structure**

The EM's structure consists of five chapters;

- a) Chapter 1 - Introduction,
- b) Chapter 2 - Dredging and Dredging Project Management,
- c) Chapter 3 - Open Water Placement,
- d) Chapter 4 - Confined (Diked) Placement,
- e) Chapter 5 - Beneficial Uses of Dredged Material.

In addition to descriptions of USACE dredging project management processes and dredge types, and detailed technical procedures for various design and operations functions, this EM contains numerous citations for the literature, especially peer-reviewed literature. This is because use of peer-reviewed procedures and methods is critical in gaining credibility and acceptance of designs and evaluations in the regulatory arena.

The policy governing accomplishment of USACE dredging is established in Engineer Regulation (ER) 1130-2-520. This ER states that dredging shall be accomplished in an efficient, cost effective, and environmentally acceptable manner to improve and maintain the Nation's waterways to make them suitable for navigation and other purposes consistent with Federal laws and regulations. The maximum practicable benefits are to be obtained from materials dredged from authorized Federal navigation projects, after taking into consideration economics, engineering, and environmental requirements in accordance with applicable Federal laws and regulations (33 CFR Parts 335-338). While this new EM provides a comprehensive summary of the dredging equipment and dredged material placement techniques used by the USACE, and describes management and design processes associated with new-work and maintenance dredging related to navigation projects, information pertaining to other types of dredging projects (such as those conducted for beach nourishment, environmental dredging, etc.) is also presented.

The USACE and U.S. Environmental Protection Agency (USEPA) have developed a consistent Technical Framework for their agencies' personnel to follow in identifying environmentally acceptable alternatives for the management of dredged material (USACE\USEPA 2004). The USACE had previously developed a Management Strategy (Francingues and others 1985) for evaluation of dredged material alternatives, which focused on contaminant testing and controls. USEPA later initiated development of a similar management strategy focusing on environmental considerations of disposal alternatives. A USACE/USEPA work group was subsequently formed for the purpose of developing the joint Technical Framework, which has been endorsed by both agencies. The Technical Framework is intended to serve as a consistent "roadmap" for USACE and USEPA personnel in evaluating the environmental acceptability of dredged material management alternatives. The structure of the Technical Framework was adopted and expanded upon in the new EM.

The Technical Framework and the new EM provides:

- a) A general technical framework for evaluating the environmental acceptability of the full continuum of dredged material management alternatives (open water placement, confined (diked) placement, and beneficial uses applications).

b) Additional technical guidance to supplement present implementation and testing manuals for addressing the environmental acceptability of available management options for the discharge of dredged material in both open-water and confined sites.

c) Enhanced consistency and coordination in USACE and USEPA decision-making in accordance with Federal environmental statutes regulating dredged material

The overall Technical Framework for developing environmentally acceptable alternatives for the discharge of dredged material is illustrated in Figure 1. Additional portions of the framework pertaining to the detailed assessments of open water disposal, confined disposal, and beneficial use alternatives are illustrated in Figures 2, 3, and 4. Chapters 3, 4, and 5 of the EM (Open Water Placement, Confined Placement, and Beneficial Uses, respectively) present more information and detailed technical procedures for various design and operations functions pertaining to the Technical Framework as it applies to each placement alternative. The major sections of each attendant EM chapter are generally referenced to the major pertinent blocks in the flow charts. Overviews of the contents of the EM chapters are presented in the following section.

## **Chapter Overviews**

### ***Chapter 1 - Introduction***

This chapter primarily presents the purpose of the EM. The purpose of the EM is to provide a comprehensive summary of the dredging equipment and dredged material placement techniques used by the USACE, and to describe management and design processes associated with new work and maintenance projects. Guidance is provided on: 1) the evaluation and selection of dredging equipment, 2) planning, designing, constructing, operating, and managing environmentally-acceptable open water and confined dredged material placement areas to provide adequate storage volume for both short- and long-term disposal (or placement) needs, and 3) planning, designing, developing, and managing dredged material for beneficial uses, incorporating ecological concepts and engineering designs with biological, economical, and social feasibility.

### ***Chapter 2 - Dredging and Dredging Project Management***

This chapter presents an overview of USACE dredging regulatory activities, project management processes, and provides a comprehensive summary of the dredging equipment used for activities associated with new work and maintenance projects. Guidance on the evaluation and selection of dredging equipment is provided and environmental considerations associated with dredging are discussed. An overview of the evaluation, selection, and management of dredged material placement alternatives is also presented.

### ***Chapter 3 - Open Water Placement***

This chapter provides guidance for open water placement of dredged material. Open water placement environments, and associated dredging and placement, and placement site management practices are described. Techniques to predict the short- and long-term movement of dredged material at the placement site for purposes of evaluating site capacity are discussed, and guidance is provided for required environmental evaluations of open water discharge (including contaminant pathways). Guidance is provided on evaluating and designing placement alternatives for uncontaminated and contaminated material in addition to descriptions of contaminant control measures for open water placement. Operational procedures and equipment configurations to control dispersion at the site are also presented.

### ***Chapter 4 - Confined (Diked) Placement***

Chapter 4 provides detailed guidance for confined (diked) placement of dredged material in confined disposal facilities (CDFs). Guidance for evaluating site conditions, retention of dredged material and initial storage requirements during placement, long-term storage capacity, dredged material dewatering, dike design, contaminant pathways and controls, operation and management, and monitoring is presented.

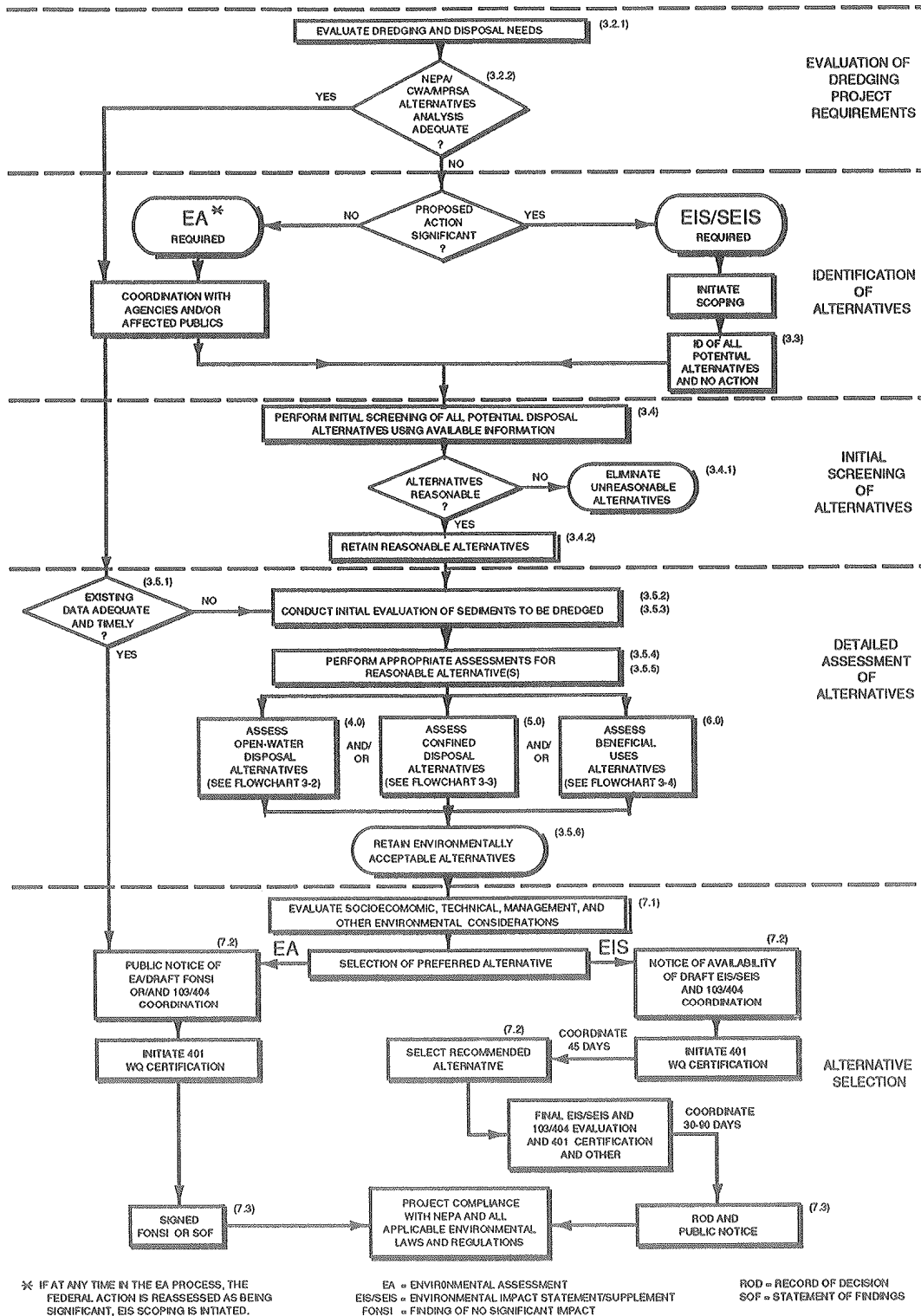


Figure 1. Framework for Determining Environmental Acceptability of Dredged Material Disposal Alternatives (USACE/EPA 2004)

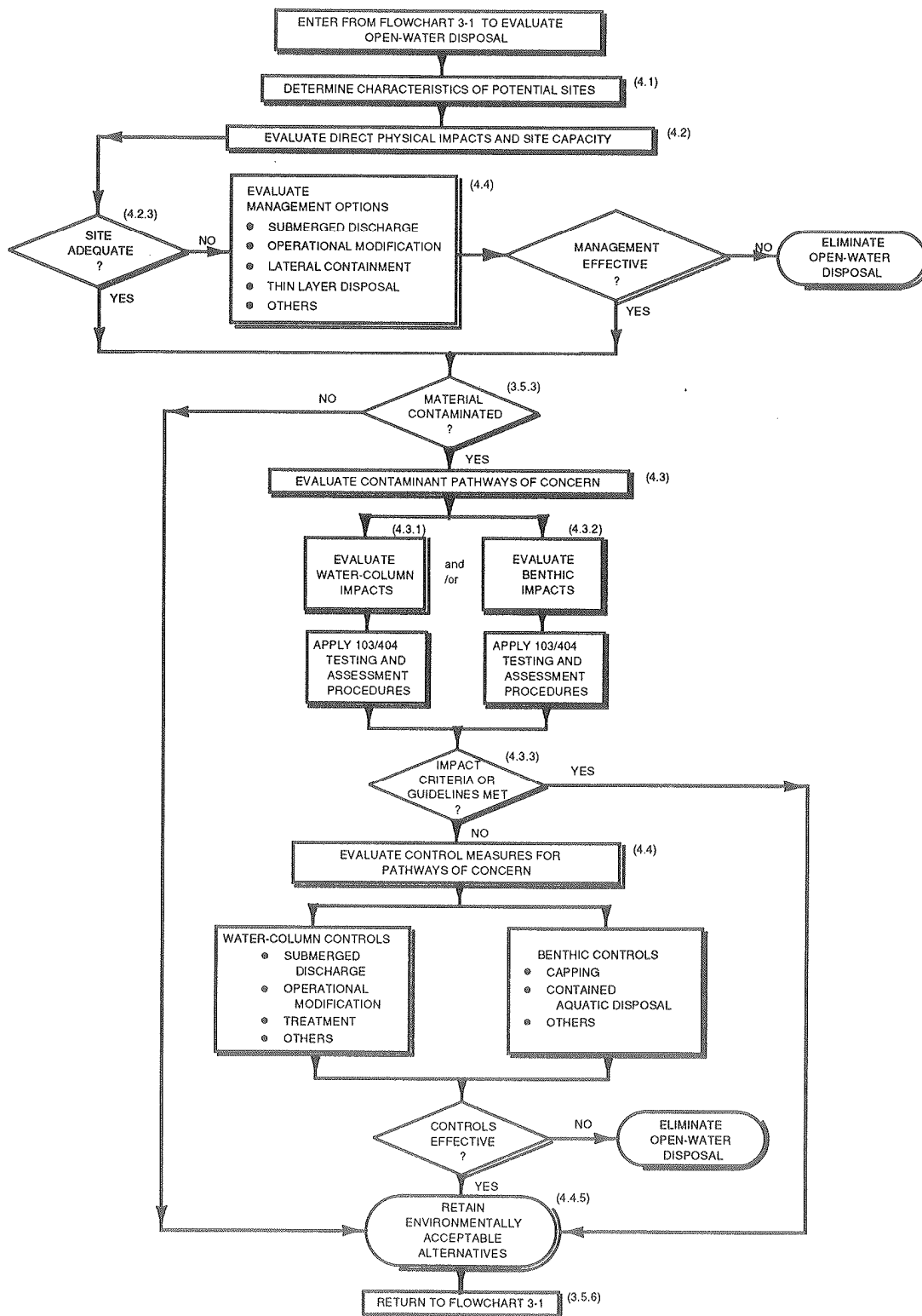


Figure 2. Framework for Testing and Evaluation for Open Water Disposal (USACE/EPA 2004)

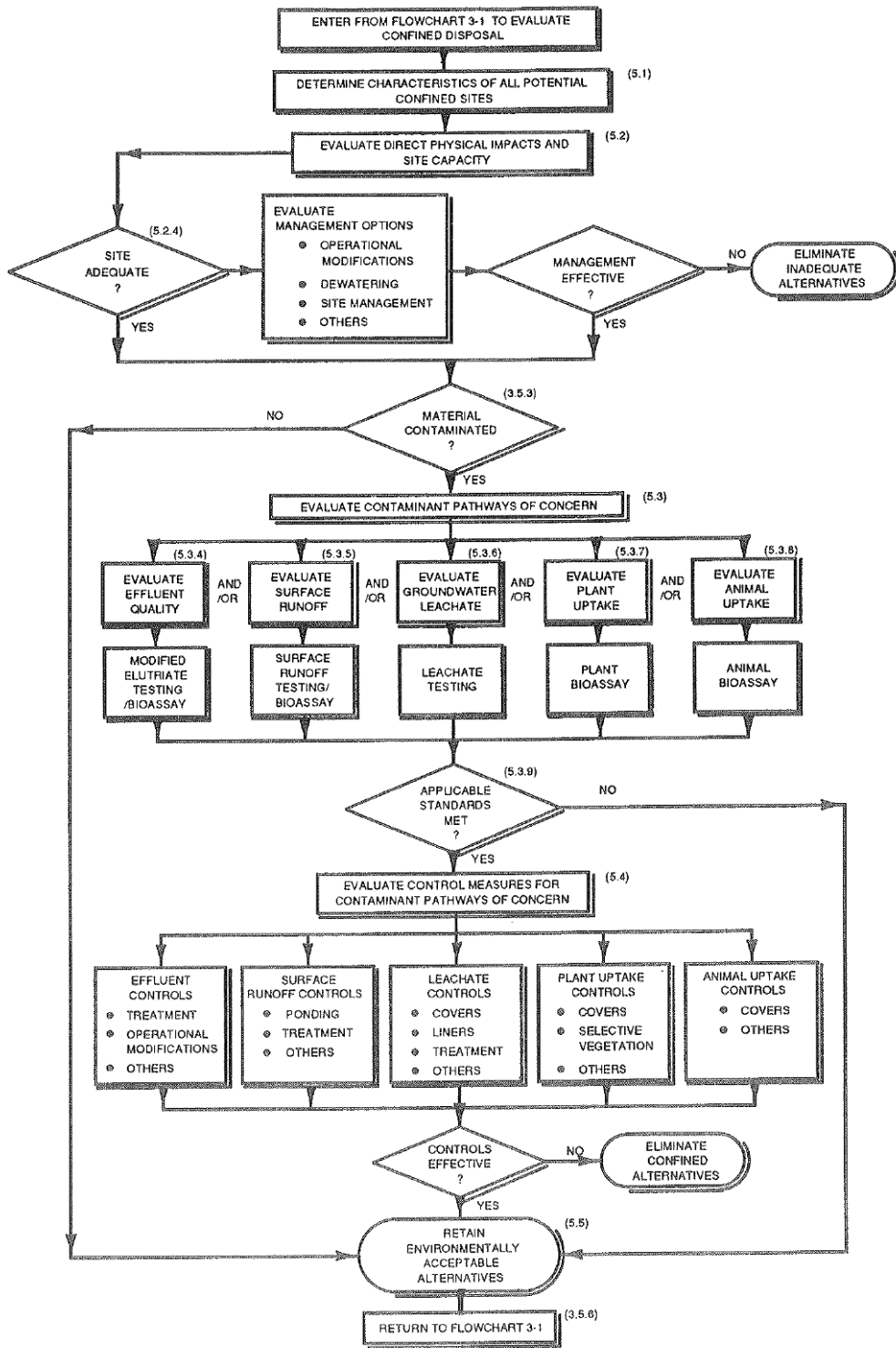
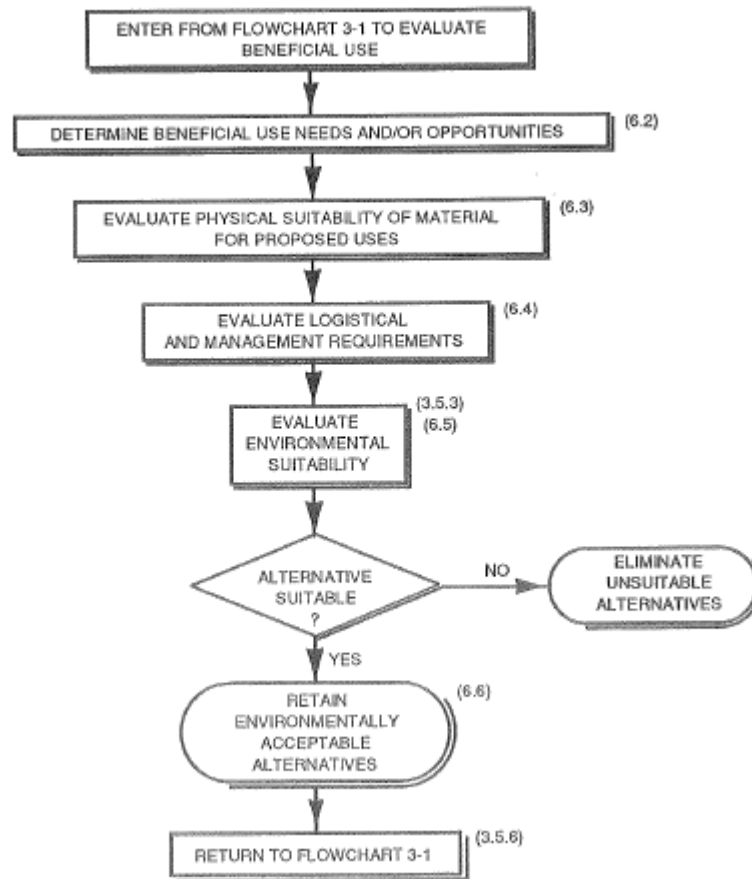


Figure 3. Framework for Testing and Evaluation for Confined (Diked) Disposal (USACE/EPA 2004)



**Figure 4. Framework for Testing and Evaluation for Beneficial Use Application (USACE/EPA 2004)**

### ***Chapter 5 – Beneficial Uses of Dredged Material***

Chapter 5 outlines various opportunities for the beneficial use of dredged material and provides many case studies. The most common beneficial use for dredged material is as substrate for habitat development. This chapter outlines the important design elements for several habitats ranging from aquatic to upland. Other uses include agriculture, horticulture, aquaculture, forestry, strip mine reclamation, solid waste landfill, harbors & ports, and as fill for many other types of projects. As sediment, dredged material has seemingly infinite uses. That is, wherever sediment is needed, dredged material could be the source. Economics generally dictate whether a given beneficial use is feasible. Some guidance for estimating costs is provided as well as engineering properties of dredged material pertinent to the variety of beneficial uses.

#### **Availability**

The final draft of this EM is currently undergoing final review by Headquarters USACE and will be made available on the USACE web site <http://140.194.76.129/publications/eng-manuals/> for unlimited distribution in portable document format (PDF). In order to read or print the document, Adobe Acrobat Reader (provided at the site) must first be downloaded. Hyperlinks to referenced and/or additional documentation [i.e., navigation/dredging-related Engineered Regulations (ERs) and other EMs (i.e, Hydraulic Design of Deep-Draft Navigation Projects and Environmental Engineering for Small Boat Basins)] are provided throughout the EM to facilitate the retrieval of more detailed information.

## SUMMARY

The USACE has updated and merged three of its dredging Engineer Manuals (EMs) into a single document, EM 1110-2-5025, Dredging and Dredged Material Management (USACE 2009). The new edition describes the dredging equipment and disposal techniques used in the United States, and provides management, engineering, and design guidance for activities associated with new work and maintenance projects. It also provides guidance for planning, designing, constructing, operating, and managing open-water and confined dredged material disposal areas, and beneficial use applications. This new EM will be made available on the USACE web site <http://140.194.76.129/publications/eng-manuals/> for unlimited distribution.

## ACKNOWLEDGEMENTS

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